

DATE: June 19, 2015

FROM: Mario Mangino
Toxicologist
Land & Chemicals Division
Remediation & Reuse Branch

TO: Todd Gmitro
Corrective Action Project Manager
Land & Chemicals Division
Remediation & Reuse Branch

SUBJECT: Corrective Measures Study Interim Report – Soil Vapor (May 2015);
GE Aviation - Evendale Facility

The Report named above has been submitted to the U.S. EPA by O'Brien & Gere Engineers, Inc. on behalf of the GE Aviation Corp. My understanding is that GE wants to submit certain sections of its planned complete CMS in advance as individual Reports to EPA. GE is requesting preliminary review of the individual Reports to ascertain EPA's opinion on the format, data presentation, and general conclusions. EPA could provide comments on the Reports, but those comments would be preliminary in nature and would not preclude EPA from requiring revisions and additional studies in order to complete or approve a full CMS Report.

At your request, I have performed an expedited review of the above document to get an understanding of the chlorinated VOC vapor monitoring studies performed at the site, the comparison of the measured chlorinated VOC constituents to health based screening levels, and the conclusions made in the Report regarding the significance of the VOC exposure pathway and human health.

My observations and recommendations are focused on the following general topics addressed in the Report:

Section 1.3.1 Generic Input Parameters

The Section states that a default attenuation factor of "soil vapor-to-indoor air" of 0.03 was used to develop soil vapor screening levels employed in the analysis. EPA concurs with the use of the 0.03 default value as an appropriate value for typical industrial/commercial buildings. However, since the soil vapor screening starts from an acceptable indoor air inhalation level, EPA prefers to label the 0.03 value as the "indoor air-to-soil vapor" attenuation factor.

Section 1.3.3 Applicable Screening Levels

This Section describes the methodology used to develop risk-based soil vapor screening levels. Based on my interpretation of EPA risk guidance and EPA's toxicological evaluation of TCE and PCE, I have the following observations and suggested revisions.

- 1) For the VOC constituents trichloroethene (TCE) and tetrachloroethene (PCE), both cancer and non-cancer health endpoints need to be considered in developing risk-based screening levels for

inhalation exposure. The starting point for calculating a cancer based screening level is the Inhalation Unit Risk (IUR) for the specific constituent. The starting point for calculating a non-cancer screening level is the Inhalation Reference Concentration (RfC). Then the respective toxicity factors are combined with the exposure factors for inhalation exposure and the target risk or hazard level that is the basis for the screening level.

- 2) For TCE, the IUR is $4.1\text{E-}06 \text{ (ug/m}^3\text{)}^{-1}$ for potential renal cancer and the target cancer risk range is $1\text{E-}06$ to $1\text{E-}04$ (1 in 1,000,000 to 1 in 10,000). The RfC is 2 ug/m^3 and the target hazard quotient is 1 based on the developmental pathway to protect the fetus for cardiac abnormalities. Therefore the receptor is a woman of child-bearing age in a residence or workplace (EPA; 2011 IRIS file).
- 3) For PCE, the IUR is $2.6\text{E-}07 \text{ (ug/m}^3\text{)}^{-1}$ for the potential of multiple cancer types and the target cancer risk range is $1\text{E-}06$ to $1\text{E-}04$ (1 in 1,000,000 to 1 in 10,000). The RfC is 40 ug/m^3 and the target hazard quotient is 1 based on protection for neurotoxicity, cognitive deficits, and vision abnormalities in occupationally and non-occupationally exposed persons (EPA; 2012 IRIS file).

Residential Screening Levels

EPA concurs with the use of a target cancer risk level of $1\text{E-}06$ for residential VOC screening. That results in indoor air screening levels of 0.43 ug/m^3 for TCE and 9.4 ug/m^3 for PCE which are more conservative (i.e., lower) than the corresponding screening levels derived using a target hazard quotient of 1. The resulting soil vapor screening levels are 14.3 ug/m^3 for TCE and 313 ug/m^3 for PCE using the attenuation coefficient of 0.03. EPA concurs with those values as shown in the Table on page 4.

Industrial Screening Levels

EPA concurs with the use of a target cancer risk level of $1\text{E-}05$ for industrial building VOC screening. The Report used a screening level of 30 ug/m^3 for TCE and 470 ug/m^3 for PCE. However, these values are less conservative (higher) than the screening levels based on a target hazard quotient of 1. Consequently, EPA recommends that the indoor air screening levels should be 8.4 ug/m^3 for TCE and 168 ug/m^3 for PCE. [Those values were derived by assuming residential screening levels could be adjusted upward by a factor of 4.2 to account for the difference between residential occupancy hours vs industrial building occupancy hours (i.e., 168 hours per week ÷ 40 hours per week).] The resulting soil vapor screening levels are 280 ug/m^3 for TCE and 5600 ug/m^3 for PCE using the attenuation coefficient of 0.03. EPA recommends making the above revisions to the values shown in the Table on page 4.

Section 4.2 Sub-slab and Indoor Air Sampling

During the 2006 vapor study, indoor air samples were collected in Buildings 500, 700, 703, 800, and Buildings B and C. Sub-slab vapor samples were collected beneath Buildings 700 and 800. The results of the sampling and analysis for TCE and PCE are shown on Figure 4.

The Report states that no indoor air concentrations of TCE or PCE were detected above the corresponding indoor air screening levels. However, it was noted that TCE indoor air concentrations of 21 ug/m^3 and 26 ug/m^3 were found in Building B. Those concentrations exceed the revised indoor air screening levels recommend above. According to the Report and EPA's conversation with Scott Cormier (O'Brien & Gere Inc.; June 4, 2015), Building B and Building C are no longer occupied and are scheduled for demolition. Therefore, the sample results from 2006 for Building B are no longer a current concern. In the event that GE would elect to reconstruct another occupied building above the concrete slab at

former Building C, EPA may elect to request additional indoor air sampling in the new building, possibly combined with sub-slab sampling to demonstrate that indoor air concentrations of TCE and PCE are not a human health concern.

The sampling results for Buildings 500, 700, 800, and 703 showed that TCE and PCE were above their sample detection limits but no indoor air concentrations of TCE and PCE were above the corresponding indoor air screening levels. One sub-slab sample was collected and analyzed beneath Building 700 (SS-700-01) and Building 800 (SS-800-01). Sample SS-700-01 had a TCE concentration of 66000 ug/m³ and Sample SS-800-01 had a TCE concentration of 3600 ug/m³. Consequently, for both of those sub-slab samples, the TCE concentrations exceeded the recommended sub-slab TCE soil gas screening level of 293 ug/m³ by a significant factor.

Based on the above VOC vapor sampling results which showed that indoor air concentrations of TCE and PCE were below the health-based screening levels, the Report concluded that the vapor intrusion pathway is incomplete at the on-site industrial buildings. EPA regards that as a tentative conclusion for the following reasons: 1) the vapor sampling results of 2006 were a “snapshot in time” representing a single sampling event; 2) Although the indoor air TCE concentrations were below the screening level, the detection of TCE combined with the high sub-slab TCE concentrations are inadequate to rule out the possibility that vapor intrusion is a complete pathway for Building 700 and Building 800, and possibly for Building 703 and Building 500 as well.

Consequently, for the purpose of ruling out or making a “closer decision” on the vapor intrusion pathway for on-site occupied buildings, EPA should recommend additional chlorinated VOC indoor air sampling at each of the on-site occupied buildings. The indoor air sampling should preferably be combined with sub-slab vapor sampling at paired sampling locations if possible. The purpose of the sampling is to demonstrate that the conditions of low indoor TCE/PCE concentrations found in 2006 remain in place and the building construction continues to provide the same high level of vapor attenuation that was indicated from the single sampling event in 2006. EPA understands that GE is in the process of renovating or reconfiguring the space within the on-site occupied buildings. Consequently, GE should be afforded the opportunity to develop a vapor sampling plan (e.g., locations, sample numbers, sample frequency) based on the building renovations.

Section 5.2 Shallow and Deep Soil Vapor Sampling

Section 6 Summary and Conclusions

Section 5.2 summarizes the results of shallow and deep soil vapor sampling for TCE and PCE at the southern portion of the site along the east side and west side boundary of the site. The results of shallow soil gas sampling are illustrated on Figure 5, and the results of deep soil gas sampling are illustrated on Figure 6. The results indicate that levels of TCE and PCE have been attenuating or trending significantly downward over time at the shallow soil gas monitoring locations. For example, on the east side of the site boundary, shallow soil gas concentrations which exceeded the residential TCE soil vapor screening level in October 2011 at vapor monitoring locations PMW-3S and OSMW-10S have trended consistently downward to fall below the screening level in January 2015 and January 2012, respectively. On the west side of the site boundary, shallow soil gas concentrations of TCE and PCE have not exceeded residential or industrial soil vapor screening levels for any sampling events from October 2011 through January 2015. The west side soil vapor sampling is the most direct sampling for evaluating whether there needs to be a concern for potential vapor intrusion at the off-site residential location.

The results of deep soil gas sampling are illustrated on Figure 6. On the east side of the site boundary, deep soil gas concentrations exceeded the residential and industrial TCE soil vapor screening level at two monitoring locations in October 2011 (location AF-7D and location PMW-3D). The high TCE concentrations for those two locations (86000 ug/m³ and 42000 ug/m³, respectively) have trended downward at both locations. (A TCE concentration of 19000 ug/m³ was found at AF-7D in March 2013.) A significant finding is that shallow soil gas samples collected above the deep soil gas samples showed TCE concentrations more than 20 times lower than the deep soil gas concentrations. This is evidence that the soil stratigraphy of the site is providing resistance to upward vapor migration. On the west side of the site boundary, no exceedances of TCE or PCE vapor screening levels have been detected, with the last round of sampling having occurred in March 2013.

Based on the above results for TCE/PCE soil vapor sampling and the results of groundwater monitoring in the perched groundwater zone, the Report reached the conclusion that the vapor intrusion pathway to off-site residential dwellings and to off-site commercial buildings was likely to be incomplete. That conclusion appears to be valid based on the multiple lines of evidence presented in the Report.

As GE moves forward toward developing its complete CMS for the site, EPA should consider requesting the following actions and information: 1) Continue shallow and deep soil gas monitoring for chlorinated VOCs at any soil gas monitoring locations which have shown an historic exceedance of a chlorinated VOC soil gas screening level. The data would support the finding that soil gas VOC concentrations continue to trend downward or remain low at the southern portion of the site. A semi-annual monitoring schedule could be considered. 2) Based on GE's conceptual site model that dissolved phase constituent VOCs in shallow groundwater appear to be the primary source of VOCs in soil vapor, provide a combination of groundwater model diagrams or cross-section diagrams to illustrate the location and extent of the perched groundwater zone across the southern portion of the site. The diagram(s) should indicate the locations of perched zone groundwater monitoring wells and IRM extraction wells.